UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/028,067	12/21/2001	Tong Shi	S01.12-0860/STL 10458	2905

7590 07/13/2004

Theodore M. Magee
WESTMAN CHAMPLIN & KELLY
Suite 1600 - International Centre
900 South Second Avenue
Minneapolis, MN 55402-3319

EXAMINER	
RODRIGUEZ, GLENDA P.	
ART UNIT	**PAPER NUMBER**
2651	4

DATE MAILED: 07/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/028,067	Applicant(s) SHI, TONG	
	Examiner Glenda P. Rodriguez	Art Unit 2651	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-18 and 22-25* is/are rejected.

7)☒ Claim(s) *11,12 and 19-21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/21/2001*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4-6, 22, 23 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimoda (US Patent No. 6, 122, 120).

Regarding Claim 1, Shimoda teaches a method of identifying an equalization target for a channel, the method comprising:

Measuring a goodness metric for a first candidate target by reading data through the channel (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, Lines 38-58. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to select the smaller value.);

Measuring the goodness metric for a second candidate target by reading data through the channel (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-58. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values. The branch metric value chosen in Shimoda's invention minimizes the error in the channel by selecting the branch metric value closest to the target value

according to the Applicant's Specification in Page 6, 1st paragraph of the expression "goodness metric". The Applicant discusses that a "goodness metric" is the best metric or how "good" is that calculated metric when compared for each segment. It is obvious to an artisan to know that by choosing the metric value that is closest to the target is therefore the metric that is best or does most "good" because it minimizes errors.);

And comparing the measure of the goodness metric of the first candidate target to the measure of the goodness metric of the second candidate target and selecting the target with the better measure of the goodness metric as the equalization target for the channel (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-Col. 12, L. 11. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n. The branch metric value chosen in Shimoda's invention minimizes the error in the channel by selecting the branch metric value closest to the target value according to the Applicant's Specification in Page 6, 1st paragraph of the expression "goodness metric". The Applicant discusses that a "goodness metric" is the best metric or how "good" is that calculated metric when compared for each segment. It is obvious to an artisan to know that by choosing the metric value that is closest to the target is therefore the metric that is best or does most "good" because it minimizes errors.).

Regarding Claim 2, Shimoda teaches all the limitations of Claim 1. Shimoda further teach wherein measuring the goodness metric for the first candidate target comprises: setting the first candidate target in the channel; placing an equalizer in the channel into adaptation mode until the equalizer adapts itself to produce equalized data that approaches the first candidate target; taking the equalizer out of adaptation mode; using the equalizer to form equalized data; and measuring the goodness metric based in part on the equalized data (Pat. 6, 122, 120; Col. 5, L. 3 to Col. 7, L.15).

Regarding Claim 6, Shimoda teaches all the limitations of Claim 5. Shimoda further teach wherein modifying the equalization target for the channel to improve the measure of the goodness metric (Pat. No. 6, 122, 120; Col. 11, L. 38 to Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n having the spectral null constraint in consideration (See Col. 12, L. 25-32) in order to improve the read signal.).

Regarding Claim 22, Shimoda teaches a method for selecting an equalization target, the method comprising:

> Selecting a spectral null constraint (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then

changes the equalization target tap coefficients because of the selected B_n having the spectral null constraint in consideration (See Col. 12, L. 25-32).);

And a step for selecting the equalization target by at least using initially the spectral null constraint (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32 and Col. 12, L. 25-32. Shimoda therefore takes into consideration the spectral null constraint initially prior to selecting the equalization target.).

Regarding Claims 5 and 23, Shimoda teaches all the limitation of Claim 5. Shimoda further teach wherein the first candidate and the second candidate are constrained to have a spectral null (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-Col. 12, L. 11. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n according to the spectral null constraint consideration (See Col. 12, L. 25-32).).

Regarding Claims 4 and 25, Shimoda teaches all the limitations of Claims 1 and 23, respectively. Shimoda further teach modifying the equalization target for the channel to improve the measure of the goodness metric (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-Col. 12, L. 11. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n.).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimoda (US Patent No. 6, 122, 120) in view of McEwen et al. (US Patent No. 6, 732, 328). Shimoda teaches all the limitations of Claim 2. Shimoda fails to teach wherein measuring the goodness metric based in part on the equalized data comprises: performing post-processing on the equalized data to form post-processing data; and measuring the number of parity errors in the post-processing data. However, this feature is well known in the art as disclosed by McEwen et al., wherein it teaches performing post-processing on the equalized data to form post-processing data; and measuring the number of parity errors in the post-processing data (Pat. No. 6, 732, 328; Col. 4, L. 3-56). It would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to modify Shimoda's invention in order to provide optimized high rate channel codes for error-events (Pat. No. 6, 732, 328; Col. 3, L. 65 to Col. 4, L. 3).

Claims 7-10, 15-17 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimoda (US Patent No. 6, 122, 120) in view of Sawaguchi et al. (US patent No. 5, 539, 588).

Regarding Claims 7 and 24, Shimoda teach all the limitations of Claim 6. Shimoda fails to teach adjusting the initial equalization target so that it no longer satisfies the spectral null constraint. However, this feature is well known in the art as disclosed by Sawaguchi et al. wherein it teaches adjusting the initial equalization target so that it no longer satisfies the spectral null constraint (Pat. No. 5, 539, 588; Col. 3, L. 34-52. Sawaguchi et al. teach a magnetic recording/reproducing apparatus in which it selects the next to the lowest spectral null constraint.). It would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to modify Shimoda's invention in order to improve the frequency characteristic degradation in the medium (Pat. No. 5, 539, 588; Col. 2, L. 12-19).

Regarding Claim 8, Shimoda and Sawaguchi et al. teach all the limitations of Claim 7. Shimoda further teach modifying the equalization target for the channel comprises sequentially adjusting single terms in the equalization target for the channel (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n in order to optimize the coefficients.).

Regarding Claim 9, Shimoda and Sawaguchi et al. teach all the limitations of Claim 7. Shimoda further teach modifying the equalization target for the channel comprises increasing all of the terms of the equalization target for the channel at the same time (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n in order to optimize the coefficients. It is obvious to a person of ordinary skill in the art to know that the medium will be able to change all the target values have to be changed (either increased or decreased) in order to optimize the performance of the read channel.).

Regarding Claim 10, Shimoda and Sawaguchi et al. teach all the limitations of Claim 7. Shimoda further teach wherein modifying the equalization target for the channel comprises changing pairs of terms in the equalization target (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out

of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n in order to optimize the coefficients. It is obvious to a person of ordinary skill in the art to know that the medium will be able to change pairs the target terms have to be changed in order to optimize the performance of the read channel.).

Regarding Claim 15, Shimoda teaches a method of forming an equalization target for a channel, the method comprising:

> Searching through a plurality of candidate equalization targets that satisfy a spectral null constraint to locate an initial equalization target that provides a best goodness measure (Pat. No. 6, 122, 120; Col. 11, L. 38-Col. 12, L. 32. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n having the spectral null constraint in consideration (See Col. 12, L. 25-32). The branch metric value chosen in Shimoda's invention minimizes the error in the channel by selecting the branch metric value closest to the target value according to the Applicant's Specification in Page 6, 1st paragraph of the expression "goodness metric". The Applicant discusses that a "goodness metric" is the best metric or how "good" is that calculated metric when compared for each segment. It is obvious to an artisan to know that by choosing the metric value that is closest to the target is therefore the metric that is best or does most "good" because it minimizes errors.);

Shimoda fails to teach adjusting the initial equalization target so that it no longer satisfies the spectral null constraint. However, this feature is well known in the art as disclosed by Sawaguchi et al. wherein it teaches adjusting the initial equalization target so that it no longer satisfies the spectral null constraint (Pat. No. 5, 539, 588; Col. 3, L. 34-52. Sawaguchi et al. teach a magnetic recording/reproducing apparatus in which it selects the next to the lowest spectral null constraint.). It would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to modify Shimoda's invention in order to improve the frequency characteristic degradation in the medium (Pat. No. 5, 539, 588; Col. 2, L. 12-19).

Regarding Claim 16, Shimoda and Sawaguchi et al. teach all the limitations of Claim 15. Shimoda further teach adjusting the initial equalization target comprises adjusting the initial equalization target so that the goodness measure is improved (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-Col. 12, L. 11. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n.).

Regarding Claim 17, Shimoda teaches all the limitations of Claim 16. Shimoda further teach modifying the equalization target for the channel to improve the measure of the goodness metric (Pat. No. 6, 122, 120; Col. 1, L. 54 to Col. 2, L. 7, Col. 2, L. 21-32 and Col. 11, L. 38-Col. 12, L. 11. Shimoda teaches receiving signals from the read head and wherein it calculates branch metric values (B_n) out of the received signals in order to compare and select the smaller value out of the branch metric values and then changes the equalization target tap coefficients because of the selected B_n.).

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimoda in view of Leung et al. (US Patent No. 6, 546, 518). Shimoda teaches all the limitations of Claim 1. Shimoda fails to teach wherein the identified equalization target for the channel is of the form (1-D) $(4+6D+2D^2+D^3)$. However, this feature is well known in the art as disclosed by Leung et al., wherein it teaches equalization targets in the order of (1-D) $(1+D)^N$ in which N can be 1, 2, or 3 (Pat. No. 6, 546, 518; Col. 1, L. 45-61. Leung et al. teach a (1-D) $(1+D)^N$ in which N can be 1, 2, or 3, being able to create an equalization target of a power D^3. It would have been obvious to a person of ordinary skill in the art to have specific coefficients for the equalized polynomial in order to minimize noise in the signal being read.). It would have been obvious to a person of ordinary skill in the art, at the time the invention was made to modify Shimoda's invention in order to have specific coefficients for the equalized polynomial in order to minimize noise in the signal being read (Pat. No. 6, 546, 518; Col. 1, L. 45-61).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Leung et al. (US Patent No. 6, 546, 518). Leung et al. teach a data storage device for reading data from a medium, the data storage device comprising:

A read head for generating an electrical signal based on data stored on the medium (Pat. No. 6, 546, 518; Col. 1, L. 29-34. Leung et al. teach that the bits being read are amplified by voltages due to the transitions of magnetization orientation. It is obvious to a person of ordinary skill in the art to know that voltages are electrical signal sent through electrical devices.)

A read channel coupled to the read head for equalizing the electrical signal based on an equalization target of (1-D) $(4+6D+2D^2+D^3)$ to produce an equalized signal and for

detecting data in the equalized signal (Pat. No. 6, 546, 518; Col. 1, L. 45-61. Leung et al. teach a (1-D) $(1+D)^N$ in which N can be 1, 2, or 3, being able to create an equalization target of a power D^3. It would have been obvious to a person of ordinary skill in the art to have specific coefficients for the equalized polynomial in order to minimize noise in the signal being read.).

Claims 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimoda and Sawaguchi et al. as applied to claim 15 above, and further in view of McEwen et al. (US Patent No. 6, 732, 328). Shimoda and Sawaguchi et al. teach all the limitations of Claim 15. Shimoda and Sawaguchi fail to teach wherein locating an initial equalization target that provides a best goodness measure comprises locating an equalization target that generates the fewest parity errors in the data produced by the channel. However, this feature is well known in the art as disclosed by McEwen et al., wherein it teaches locating an initial equalization target that provides a best goodness measure comprises locating an equalization target that generates the fewest parity errors in the data produced by the channel (Pat. No. 6, 732, 328; Col. 3, L. 65 to Col. 4, L. 56). It would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to modify Shimoda's invention in order to provide optimized high rate channel codes for error-events (Pat. No. 6, 732, 328; Col. 3, L. 65 to Col. 4, L. 3).

Allowable Subject Matter

Claims 11, 12 and 19-21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding Claims 11, 12, 20 and 21, the primary reason for allowable subject matter is the inclusion of the limitation wherein selecting an equalization target that was identified for the most heads and head/zone pairs as the equalization target for the channel.

Regarding Claim 19, the primary reason for allowable subject matter is the inclusion of the limitation wherein reading data within a track on a medium and determining a first number of parity errors and reading a data within the track on a medium while the head is offset to the other side of track center and determining a second number of parity errors and taking both parity errors to identify the candidate equalization target.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. NA 9404493 to IBM Technical Disclosure, 6285520 to Makiura et al., 6, 249398 to Fisher et al., 4, 888, 779 to Karabed et al., 5, 128, 811 to Van Gestel, 6, 243, 847 to McClellan et al., 2002/0101674 to Ichihara et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Glenda P. Rodriguez whose telephone number is (703)305-8411. The examiner can normally be reached on Monday thru Thursday: 7:00-5:00; alternate Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on (703)308-4825. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

gpr
June 30, 2004

DAVID HUDSPETH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600